

NOTE NR.1 TO EDITOR; At this point, I am beginning to prepare my last chapter. It is my plan to go back to 239.doc, the last section I had been working on before my surgery, complete it and then prepare a reasonable transition section that will be the bridge to the last chapter.

NOTE NR.2 TO EDITOR: Since this, the last chapter, is being prepared a couple of years after the book was started, there have been important changes in the information and the socio-economic worlds that should be logged and incorporated, forces that will affect how information and communication contribute to the changing world in which we live. Some of - these factors are already threaded through some passages of the book; certainly there are others that should be incorporated to make the treatise even better. Obvious ones deal with problems brought about by accelerating population growth; by increasing demands for higher standards of living on the part of the poorer countries; by senseless waves of fury, violence and crime all around the world; and the positive and negative effects of the Information Revolution unequalled. Many nations have boarded or seek to board the popular vehicle of science and technology, largely made possible by raising national educational levels. Rich and poor nations alike are arrayed on the battlegrounds of productivity and competitiveness, fighting for a favorable position. Since Japan has dramatically shown that the necessity of ample and requisite natural resources is not always a pre-condition for progress, other nations are enheartened and are "zeroing in" on research, development and education to achieve magical progress. They have learned that by obtaining the rich STI, generated by other countries, they can "leap frog" costly R&D efforts and prosper by rapid and intelligent technology transfer.

Much to its chagrin, the United States gets low grades for technology transfer and competing with Asian and European traders; this despite the fact that the United States is a world leader in the knowledge economy. In a country where in earlier years the slogan, "Root, hog or die" was the metaphor for progress, we have forgotten its lesson. Much of the R&D undertaken in our laboratories turns out knowledge of questionable single or dual-use value. This is not a good sign.

There are a number of conjectures for the causes of our sub-par performance. Crime, indolence, slumping educational achievement, drug addiction, economic recession, and the general lassitude of the public may be contributing reasons; lack of inspired political leadership may be another. This author is sad when he points out that during the last two decades, there was a grave lack of support by the Federal government for improved science communications. It may be too formidable a task to prove this point, i.e., that a poorly conceived, rudderless STI program undermined the Federal R&D program, despite the billions of dollars the citizens of this country poured into Federal R&D in recent years. .

## CHAPTER 6

### 6.0 Quest for National STI Priorities and Policies

6.0.1 In this the last chapter, the reader will find what might be described as a "stand-alone" section of the book. It is based on the previous chapters, which are largely historical, although not exclusively

so, since comparisons, appraisals and other observations of past and present conditions are already threaded through the chapters. Some applicable recommendations for Federal and national STI progress, made in earlier studies and some by the author, are exposed in the previous chapters, are brought forward for consideration. Chapter 6 speaks to the future, providing what might be called an "STI blueprint for tomorrow," addressed primarily to the Legislative and the Executive Branches of the United States government responsible for and involved in R&D, as well as STI policy formulation and technical operations. It is also addressed to knowledge workers, scholars, and others in the public and private R&D and STI sectors with the expectation that from their ranks new crusaders for improved Federal and national STI systems will emerge.

Heretofore, in addressing the visible spectrum of science communications, the focus has largely been on preventing the illegal outflow of sensitive government-generated STI, on the growth of electronic databases in the public and private sectors, on ways to provide faster and wider dissemination of STI to the public, and the need to speed up the process of converting scientific information into technological products. What has not happened in recent years is the development of a well organized program that would create a pool of trained science and information managers to provide vigorous Federal STI leadership at White House and Federal R&D agencies and for coordination and cooperation between the public and private information sectors at home and abroad.

6.0.2 In spite of the widely held belief that science communications is deemed an increasingly important tool and nationally and internationally in the Information Age, less than a handful of books have been written on the history of science communication in the United States. None, to the author's knowledge, have been written about the strategic aspects of scientific and technological information systems and the valuable STI cargo they carry. On the other hand, there is almost literally no end to the thousands of books and articles that have been written about computers and other information technology in recent years. As one cynic has observed, "You will find in the literature a mountain of "how to," books but very little on "what for" books. The writer finds this off-hand observation penetrating. During the early days of COSATI, also the early days of major U.S. information system-building and database development, there was less concern on the part of STI managers about rapidly changing generations of computers and much more concern for the beneficial employment of STI for research and application.

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6.0.3. The observant reader will be quick to learn that this book differs from the others of its genre in several ways. Firstly, it tells a yet untold story about some of the important events that took place in the 1960s to launch the first Federal STI program. The Executive Office of the President was the writer's vantage point, where he was an "insider," directly involved in the planning and coordination of the Federal STI program. Secondly, the book delves into additional actions of communication and information that engaged the attention of White House officials during the 1960s and early 1970s.

Thirdly, the book takes on the challenge of examining the STI function during a rapidly changing conditions, such as the challenging need to strengthen U.S. science and technology by means of a superior national and Federal STI program.

Fourthly, there is a need to resolve the question of the on and off on relationship of R&D management and STI management. There is hardly any doubt but that OMBs hop from paperwork reduction into Executive Branch control of information policy and management in the last few years virtually separated the R&D managers from their former responsibility for their own STI operations. This extension of power, while it might have brought some improvement to Federal information management, generally, is a determination for others, thus is not part of this book.

Fifthly, there are even larger and more compelling questions that need to be posed and answered. The first of these deals with the function of overall Federal and national science communication and the part that the Federal government, working closely with the private information sector, should embrace. Similarly, the United States government needs to undertake a leadership role in the world science community, a role that is purposive and proactive. If these views are accepted as reasonable and desirable, there is an immediate need for a competent STI cadre, supported by a thoughtful training and R&D program. If this is agreeable to OSTP leadership, immediate steps are needed to prepare requisite plans for action.

6.0.4. In light of these proposed suggestions and actions. the author likes to believe that this chapter may contribute useful as a Federal STI agenda for the next two decades; an endeavor that draws on the still undone, but viable recommendations from key reports of yesteryear, and adds new ones that resonate with the technological and socio-economic post-COSATI changes and conditions of the last quarter-century and the rapidly approaching 21st century.

6.0.5. A summarized projection of what may take place in the science communications movement of the next two decades, chancy and imperfect though the guesses may be, is offered to the reader at this point.

6.0.5.1 The global wiring-up' process will continue in all countries, expediting what will be the next stage in the evolution of a new, de facto world information order. We should expect criticism, if we appear to accept the notion that the present information order needs to be improved. Our defense should be that we are not referring to the world of the news media, but to that of science communication.

6.0.5.2 Unexpected seachanges in the political and socio-economic climate of all countries are expected to play a dramatic role for rich and poor countries alike. The developed countries (DCs) will anxiously operate at the cutting edge of the Information Age movement, giving even higher priority to such actions that they believe will improve their technological, educational and economic capabilities. Under-developed countries (UDCs), fully recognizing that advanced countries will press forward even more than before to maintain and improve their information/communication capabilities, will do whatever they can to

achieve changes that will, at the least, keep them from falling farther behind. As before, they will demand more help through international bodies, such as the United Nations, UNESCO, and other international bodies. They will interact through regional blocs to magnify their power. They will seek bilateral pacts with friendly nations to achieve economic growth. They will send their scientists, engineers, and information leaders into advanced countries, there to master information processes.

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Strategically, the Soviet Union has sought to play information "hard ball" with a virtuoso performance in information gathering during the last few decades. They have working closely with UNESCO and other U.N. bodies, to convince the DCs that they are "on their side" in the struggle with the Western World, especially the United States, for better information and computerized information systems. Unfortunately for the Soviets, there is no proof that their diligent grubbing for STI improved Soviet science and technology substantially. for political purposes,

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For many years, the Soviets have operated schools for UDCs, indoctrination centers in Moscow for African and South American nationals to teach their librarians and information specialists the Soviet library and information systems and gamble on maintaining long-term relationships with the graduates of their indoctrination schools. The latest example of their friendship campaign took place in November 1988, when the Communist Bloc and the DCs combined to ram through the latest New World Information and Communications Order (NWICO) resolution at the United Nations ( ). With the U.S. paying about one-fourth of the cost of UN and UNESCO, unless funds are being drawn from some other source, it would appear that the U.S. is, at least, contributing to the support of the Soviet courtship with the DCs. If this is true, even in part, we are being cuckolded, to put it mildly.

(Nib Item Nr.1. Cutler, B.J., The U.N. Against Freedom?, Washington Times, December 22, 1988, page F3. The writer, editor-in-chief of the Scripps-Howard Newspapers, complains that the DCs, Soviet Bloc and U.N. bureaucrats combined in a statist effort to excise the principle of freedom of the press from the resolution.

In the past, friendship rites among nations called for exchanging money, gifts, credits, loans, rare animals, cherry trees and surplus foods, but in recent years developing countries, becoming more sophisticated, will increase their calls for more needed STI and installation of modern information systems to handle it. In the meantime, we can expect that they will continue to exert their considerable voting power in the United Nations General Assembly and other international forums they can influence to demand a new global information bodies, believing this to be tactically the most effective lever to apply on the advanced STI-rich countries (ACs). Their logic is impeccable, being aware that the powerful U.S. and other Free World news media would be focusing their attention much less on the sharing of STI and much more on the maintenance of independence from governments at home and abroad.

In the interim, while the debate continues, even rages, the DCs can be expected to go 'all-out' in the quest for access to the world's best STI and state-of-the-art information machinery and systems. In this information environment, we are apt to find more political pressure blocs forming or coalescing primarily to access, share and exploit STI than ever before. In recent years, the U.S.-the quintessential 'information-have'- has not sought vigorously to play the game, as have other Western and communist countries in this arena, but circumstances and deeper thought may force a change in this attitude. It would be sophistry to assume that the U.S.I.A.'s endeavors overseas to build the U.S. image and sharing dribblets of STI as being satisfactory. Certainly, State Department science attachees and U.S.I.A. reading rooms in foreign countries do some good for the United States, beside offering inflammable targets for unruly elements in 'friendly' countries.

At the least, the U.S. should undertake new, objective studies of this subject by bona fide technical information experts, working closely with the Department of State, the technical agencies and the private sector in preparing a series of contingency plans to increase sharing involvement with selected DCs, recognizing that this will be to our political and other advantage.

6.0.3.2 It may not be a safe hypothesis, but it is possible that with more closely supervised agreements between the West and East Blocs to share STI, the incentives for espionage may decrease. This can only work in the long-term to our advantage. The only foreseeable obstacle that could generate some antagonism and foot-dragging would be the entrenched domestic security and intelligence bureaucracy that exists in all countries. One other problem. An impression exists that many pro forma STI-sharing agreements are made by politicians, rather than scientists. but few steps are taken by those agencies with the STI generators to implement the agreements, nor do those in the U.S. government who write the STI-sharing pacts bother to do follow-up on the agreements. It follows that the State Department or designation agencies should be called upon to monitor the direction an extent of STI flows to and from the United States. The results may be astounding. .

6.0.3.3 It is a safe hypotheses to assume that newer information technology will continue to be invented in the years to come, technology that will outmode whatever machinery is now in place. As it has in the past, diffusion of the new information and techniques plays havoc with installed systems, with the need to retrain operators of more sophisticated systems, and with mounting costs. As long as funds can be made available for updated information technology and systems, the process will continue. There will be greater negative impact on those organizations and individuals who are less well-heeled, especially in developing countries. Thus, there might be fewer international incidents, mostly because more belligerent but economically growing countries may not want to chance having their STI lines cut with the information 'haves.' Information geopolitics may be better understood, employed and polished in the future. This area of "cold war" will certainly be an incentive to establish an information institute at the highest levels of our - and other governments - in the future.

Another form of information geopolitical skirmish currently is being waged between two advanced countries, the U.S. and Japan. At the time this portion of the book is being written, current negotiations with the Japanese for the joint building of the advanced FSX combat plane are going on. Stung by the country's inability to guard valuable technical information that all too-often returns to the United States in the form of popular, highly competitive automotive and electronic products, the Executive and Legislative Branches are engaged in much soul-searching in many debates about the wisdom of voluntarily transferring precious U.S. aircraft-building technical knowledge to the Japanese as part of the deal. The President is leaning toward working with the Japanese, currently. Congressional committees are less accommodating. The point to make here is that the debates about sensitive information, the FSX aircraft, ICBMs, global warming, acid rain, spilled petroleum disasters, gene-splicing issues, nuclear products waste disposal and other tough questions that involve STI, available or being researched, are educating all governments and making them more conscious of STI and its value. This is why information geopolitics is a growth industry

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6.0.3.4 There are many more trends that deserve mention, but I will discuss only one more that will increasingly disturb people. The greater part of the information and data that are generated annually, is of little value or quickly becomes outmoded by new findings. This means, in a sense, that a substantial part of the conduits and banks of knowledge are in place to handle unused and unwanted information and data of low quality. The question being asked is - are we doomed to put-up with this costly problem forever or can we find a way of sifting through the annual accretion of ~knowledge" at the source to enter less but better input? There is no simple answer, but that does not dispose of the question.

6.0.3.4. This is one reason why the DCs will prefer to deal with international bodies with information databases and networks, given a choice. They will also be deeply interested in 'freedom of information' movements in various countries, as well as programs to improve or set information equipment standards

6.1.0 The Mandate to Re-invigorate the Federal Scientific and Technical Information Program

6.1.1 Why should the U.S. government want to disinter the Federal STI program that had been laid to rest in the early 1970s and start a new one?

Before answering the question, I submit to the reader the view that the United States, in my opinion, has jeopardized its own world scientific and technological leadership by allowing its Federal scientific and technical information program, once the world's best, to deteriorate. I do not believe that the misadventure that took place in the 1970s was the result of a deliberate decision of the Federal government to jettison the program. I am more inclined to the view that there was no real villain in the script. The dismantling just happened, starting in the Nixon years, and continuing through the next three administrations. The error was precipitated by ignorance of real life STI conditions and the unmeasured

opportunities that a superior STI program would assure to all levels in the public and private sectors. It is my firmly held view that the flawed decision that triggered the denouement must be reversed before even more damage is done.

This said, now to the question. Let me begin by summarizing what happened in government during the 1960s when the Congress and the White House acted in unison to establish the Federal STI program. The program was deemed so important by the President's Science Advisor, Dr. Donald Hornig, that he located its headquarters in the Office of Science and Technology and the Federal Council for Science and Technology, both of which he directed. To get the job done, he assigned technical assistants in his own small staff to operate the STI program.

After a couple of learning, warm-up, but productive years, impatient congressional and other groups called on the White House to accelerate action by giving COSATI and OST yet more authority and power to attain progress. These recommendations were made in the PSAC (Weinberg) Report, the congressional Elliot Report, and several other studies. Unfortunately, Dr. Hornig could not give COSATI any more power than he possessed, since both OST and COSATI had no legislated authority and funds, serving only at the pleasure of the President. Translation: President Johnson could appoint or discharge them at will. Neither OST or COSATI could order the agencies to do anything. The FCST committees achieved progress by means of quasi-binding agreements made by agencies to do or not do whatever the majority of the agencies thought was in the common Federal interest. Theoretically, OST could on rare occasion secure a Presidential directive to assure action in a given area. OMB, similarly, if a matter fell within its jurisdiction, could issue the equivalent of an order that would be binding on the agencies.

OST and COSATI were not that fortunate. With the passage of time, the change of administrations, and the predictable turnover of Federal R&D managers, FCST agreements became unravelled. Notwithstanding this weakness, OST and COSATI continued to carry out their missions with vigor, fervor and some success.

In 1971, a new Science Advisor, Dr. Edward David, accepted a request from NSF that originated in an STI advisory panel to NSF to transfer COSATI leadership to the Foundation. The OST director arbitrarily and without discussion with the officers and members of COSATI honored the request in 1971. Two years later, OST and FCST were themselves terminated by President Nixon. COSATI and the other committees of FCST were dissolved. NSF slowly began to disengage itself from its requested responsibility to lead the Federal STI program and ultimately drew-down its own legislated science communication program. The Congress, except for one of its members, was relatively silent when this happened.

6.1.2. From the day that the White House science program was curtailed and the title of Science Advisor was transferred to the Director of NSF, the science community clamored for the re-opening of the White House science office. When OSTP was established in the mid-1970s, for reasons unclear, it chose not to honor the intent of its enabling legislation, calling for the return of the STI function to the Executive Office of the President. The same denial took place in the FCST successor, the Federal Coordinating Committee for Science, Engineering and Technology (FCCSET), created in the same legislation that brought OSTP back to the White House; this in spite

of complaints from the framers of the OSTP legislation in Congress, who were concerned about the languishing Federal STI programs. The individual Federal agencies, taking their cue from the Executive Office of the President, permitted their own STI programs to languish, thus closing the unfortunate loop.

6.1.3. Part of the blame must be placed at the doorstep of OMB. This organization, taking advantage of a vigorous paperwork reduction campaign and some adroit political maneuvering with members of Congress, was not only able to strengthen its hand in controlling Federal paperwork procedures, but was also successful in gaining de facto control of Federal information resource management. The Federal agencies, recognizing that some of their independence over agency information processes was at stake, were almost of one mind in opposing the measure, but to no avail. The long record of faulty management of agency information management systems over the years had left them vulnerable. By dint of studies, meetings, pressure from Congress, and the need for the 'consolidation of old OMB directives', OMB set out to extend its control. With the passage of more time, OMB was able to obtain the designation of a single person within each Federal agency to act as the agency's "information czar", operating within the guidelines set forth by OMB. To give OMB due credit, in some matters of computer procurement and similar computer management areas, some gains may have been registered. But to the extent that authority over technical information matters shifted from R&D managers and OSTP-FCCSET to OMB and other non-R&D groups within agencies, there was a deterioration of STI policies, coordination and cooperation within and among the agencies. OMB had no positive STI program to offer in this specialized field..

6.1.4. One dimension of the problem came into focus, became dramatically evident, when the White House, unhinged by a series of troubling leaks and security lapses resulting in the loss of valuable technical information, decided to create a new classification for the dissemination of unclassified, but 'sensitive' technical information. It was a 'hard line' decision that even key officials in Defense Research and Engineering, Office of the Secretary of Defense, sought to dissociate themselves from at one point. To put it mildly, the White House and the agencies were amazed and chagrined when the new protective policy brought a firestorm of protest from the Congress, the media, and the private sector, a couple of years ago. This political misadventure has resulted in a climate of distrust that will be hard to put behind us in the future, even though the offending directive was hastily withdrawn by the White House.

During this acrimonious and unhappy episode, what was not generally perceived or discussed was the virtual disappearance of the White House STI program, the once powerful policy and coordinating function that flourished in the 1960s. Absent COSATI or a successor group at EOP level to find a solution, the remaining Federal STI managers were by-passed, and other groups, mainly security and administrative, were responsible for the offending directive. If the COSATI mechanism had remained in place, there probably would not have been the need for the NSA to issue its ill-fated directive. During its heyday, COSATI worked closely and harmoniously with the organizations that had joined in attacking the repressive technical information policy that infuriated them. During its period of existence, COSATI had initiated a policy of open dissemination of Federal STI that



was subsequently approved by the Federal Council for Science and Technology.

6.1.4.1. The DOD, having been stymied by the furious counterattack by the "free flow" advocates, nevertheless was not to be silenced. As 1988 came to a close, a news report written by Washington Times reporter, Paul Bedard ( ) discussed the drafting of a new regulation to control technical and other information flow, but this time, the effort was to cut off the flow of sensitive documents even to defense contractors. DTIC had legitimately maintained an electronic network for this purpose for years. All major DOD contractors were aware of or took advantage of this service. Followed revelations covered in the Washington newspapers and the national media that allegedly firms had bribed Pentagon officials in return for classified documents and other information to win weapons contracts. It is dubious that the DTIC apparatus was involved in this illegal operation.

For many years, contractors to DOD had legitimately sought access to Pentagon documents that were of general interest to them technically. All legitimate defense contractors had equal access to the program. Obviously, within such information, technical and otherwise, valuable information for contract-seeking purposes could be embedded. In the Bedard article, it was revealed that a DOD task force was organized to determine if information was improperly leaked to contractors. A letter to all contractors was released by Jack Katzen, assistant secretary of defense for production and logistics.

Also in the loop was OMB's Office of Federal Procurement Policy, whose goal it was to assure fairness in bidding. Information was required to be made equitably to all potential bidders. However, the DOD felt the need to resist premature release of draft weapons plans. This duality reveals the practical difficulties encountered when dealing with information of Federal programs that involve billions of dollars. A replica of this tale can be told about the GSA telephone contract that has consumed much attention of late. The only point I would care to make in this incident deals with STI, which plays some role in both of these contracts. If the STI experts are bypassed, there can potentially be an additional and unnecessary cost in dollars, time, and other resources. Sensitive technical information, another serious problem, is hardly affected in this episode, but both underscore the soaring importance of information in government and industry.

(BIB item) Paul Bedard, Washington Post, Pentagon Drafts Rules to Plug Flow of Illicit Information, December 26, 1988, page A3

6.1.5. With the dissolution of COSATI in 1973 came an additional string of problems. Government-wide interaction diminished to the disappearing point and governmental relationships with the growing private STI sector came to a grinding halt. There exists no official government organization to work closely with IIA and other private information sector organizations. This state of affairs is a burden for both sides, public and private. The advice that COSATI used to provide to individual agencies to achieve government-wide consensus is now largely absent, thus positions taken by individual agencies may differ widely. Interaction with professional societies on matters such as support of page charges used to be centered

in OST and COSATI. No more. COSATI used to have panels on international information affairs, legal aspects of information systems (patents and copyrights), technology transfer, information science and technology, standards, space and other numeric data, and many more as needs arose. Panels and task groups were brought into being by COSATI to anticipate, avoid or solve information problems. With the expansion of information activities in the Federal government and nationally, the need for a COSATI-like body has grown almost geometrically,

(Bib item Nr.2) Senate Judiciary Subcommittee on Technology and Competitiveness, chaired by Senator Patrick Leahy (D.Wermont), reported in Transnational Data and Communications Report, June/July 1988, pp 7 and 8.

6.1.6. In mid-1988, confirmation of the need for a new COSATI was made by Dr. Lewis Branscomb, past chief scientist for IBM and currently director of science technology policy at the J.F. Kennedy School of Government, Harvard University. The occasion was a hearing called by Senator Patrick Leahy on a bill (the Superconductivity Competitiveness Act) advanced by the administration, which, if enacted, would have excluded from coverage under the Freedom of Information Act much of the results of technological research in the United States. Dr. Branscomb stated:

that he was involved when the U.S. government first advanced the idea that science information management was a key public policy issue.(He) recalled that the seminal event was the report to the President by the Weinberg Panel of the President's Science Advisory Committee in 1968 (January 1963 was the correct date) The thrust reached its peak through the efforts of Vice-President Hubert H. Humphrey. Branscomb added, "I have lived to see most of the federal effort dismantled and a coherent policy of encouraged diffusion of knowledge replaced by a narrow-minded, ill-informed strategy that experiments with intellectual protectionism."

Branscomb went on to say that other industrial democracies take information policy more seriously than does the U.S. and as an element of their science policy. He stated, "In the U.S., for reasons I have never understood, information policy is the stepchild of economic policy and has lost its place in science policy. We spend our time discussing what information to keep, sell or give away. The better question is how to create it, acquire it and use it."

Senator Leahy saw the 'administration's attack on the FOIA and its short-sighted ploy to put clamps on government and private databases' as part of a pattern that for him raises several questions. He asked:

Will American scientists be denied access to information about scientific discoveries in other countries, if we restrict foreign participation in our own country? Will our allies turn away from our information industry, if the U.S. government restricts the access of foreign nationals to public information contained in databases like Lexis/Nexis? Can we as a nation afford these costs? FOIA promotes the free exchange of ideas and openness in our society, which is the cornerstone of our system of government, the key to research advances and our economic competitiveness.

Branscomb picked up on this theme:

Now times have changed with two contradictory effects: the economic importance of uninhibited exchange of scientific and technical knowledge has increased, calling for even more flexibility in information management. At the same time, both the military and the corporations have responded to external competition with increasingly defensive attitudes towards information flow...Results of new science we share freely, not from generosity but because when we share we receive back more than we give. The value of an isolated item of research is limited; the value of the collective product of many productive minds inquiring along similar lines can be immense. Progress requires collective, cooperative action ...If government policy favors free trade in goods, then it must also allow, indeed insist, on fair and free trade in knowledge. If government wishes to participate, however modestly, in collaborating with industry, then government must be prepared to recognize that value protection is essential to the encouragement of knowledge diffusion.

6.1.7 Dr. Branscomb and Senator Leahy hit the nail on the head on two counts. First, the abandonment of White House and Federal science information management efforts that we pioneered was short-sighted and we are now paying for the myopia. Second, so perfectly expressed by Dr. Branscomb, when scientific knowledge is sequestered, it inevitably leads to isolation from the world pool of STI.

6.1.8 The answer to the competitiveness dilemma we face is to change our ways to quicken our national ability to exploit the knowledge we produce or that is produced by individuals or laboratories in other countries. This is our best and most consistent approach. Failure in making the change from sluggish exploiter to fast exploiter may be our undoing. There are other reasons why the need is imperative. Better information systems would contribute more to the success and productivity of our Federal and national research and development programs. Information systems, properly developed and operated, can usefully upgrade processes that enhance industrial and commercial programs, thus leading to national competitiveness. By deploying appropriate, greatly improved, integrated and finely tuned STI and other contributing information programs, we ought to be able to get ahead and stay ahead of our trade rivals around the world.

6.1.9 A priority task for the Executive Branch, working harmoniously with Congress and the private sector, is to undertake a realistic study of the key information factors, current and expected, that will be involved in the further growth of the global marketplace. But, at the same time, we must maintain and improve the information systems and subsystems that are necessary to sustain a sovereign nation, recognizing that it would not take much of a wind change in the political climate to deter globalization of industry and commerce. Some of our current Federal and national STI and related information systems, which are in place today, came into being largely in an uncoordinated, unplanned manner. We can assume that some of them are duplicative and overlapping for these reasons, and, if they continue as they are, will negatively affect vital internal communications and sharing of information. Failure to make improvements will predictably result in higher comparative costs than those of our rivals in the foreseeable future. We can be certain that our rivals will install and

employ whatever information systems will give them an edge. Our failure to move forward similarly, even though the requirement is clearly visible, the problems so numerous, and so foreboding, is, in my mind, close to criminal neglect.

## 6.2 0 We Must Amend the Law that Established OSTP to Require OSTP to Take Full Responsibility for Federal and National STI Matters

6.2.1. Experience has shown that White House action to improve the Federal STI program will probably not be self-initiated. There are good reasons for this assertion. First, such a course of action is not high on the list of priorities of influential scientists and engineers in the United States. Their priorities usually deal with 'big buck+' items, such as space, superconductivity, supercomputing, bioengineering, etc. that require breakthroughs, hence new laboratories and other facilities, vast budgets and corps of scientists and engineers.

6.2.2. The challenge of the Weinberg (PSAC) Report that called on the technical sector (R&D managers, scientists and engineers) to take primary responsibility for science communications has regrettably fallen on deaf ears. At the most, only a small fraction of scientists in the United States and elsewhere have accepted responsibility for preparing the learned journals used to print the research articles and reports produced in each of the major scientific fields. Sadly, they have not earned the respect of their colleagues whose goals are more traditional, the search for new discoveries, fame and, for a few, money. Some of the science-informationists have embraced electronic data bases and networks operating internationally, but even in this circle of the annointed, there is no more than a ripple of interest in across-the board discipline and the more eclectic information systems and programs that will come in the future.

6.2.3. This lack of interest among scientists was also evident when, in 1971, the Director of the United Nations Educational, Scientific and Cultural Organization (UNESCO) and International Council of Scientific Unions (ICSU) convened an international group of scientists, engineers and information experts to consider a task force-recommended global STI initiative for establish a World Science Imformation Program. The attendees in the main were won over, but when scientific journals and newsletters carried the news and described the plan to the rank and file of American scientists and engineers, their enthusiasm and acceptance, both required to build the necessary consensus that would be needed for action, failed to materialize. Predictably, science leadership, typically unable to look at the "big science picture", was indifferent and silent. As mentioned elsewhere in this book, their interest is focused elsewhere.

6.2.4. Today, the rapid, 'institutionalization' of some aspects of national and international science information processes, an eventuality anticipated by Information Age thinkers, and the expanding information needs of society growing more complex by the hour, remain virtully unaddressed by major scientific groups, nor will they be until government leadership shows renewed interest in the orderly growth of their own information programs and systems. During the late 1970s and 1980s, recognizing this need as a fact of life, several critics, myself included, made repeated suggestions that OSTP follow the trail blazed by its

predecessor, OST. Once a solid start was made in formulating appropriate Federal information policies, action should then be taken, working closely with leaders in the private sector, to prepare the first draft of a national STI policy. If OSTP produces a commendable first draft, it would, on a de facto basis, take on the leadership of Federal and national STI policy program development once again as it did in the 1960s. On several occasions, I petitioned OSTP to return to the STI business and invariably, the answer coming back from OSTP was, "Yes, the idea is meritorious, but we simply lack the people on our staff to do the work." When reminded that they could borrow capable people from the Federal agencies to run the program and that actually only a handful were needed, I got an additional 'put off' from OSTP officials, i.e., "Only when the American scientists and engineers, en masse, demanded an improved Federal and national STI program would OSTP listen. No clue was given about the size of the sample that would satisfy OSTP was provided; undoubtedly it would have to be a very large one to be convincing.

6.2.5. The message was clear. OSTP was not ready or willing to undertake the task. Without conviction of its own, it is more than probable that yet another excuse to avoid action would be forthcoming. My guess is that OSTP's next avoidance gambit would be a requirement that Federal R&D agencies come forward as a group and formally ask OSTP to set up an STI coordinating and planning function in its office. I do not think that the agencies would do this, unless there was a strong force in Congress to 'encourage' them actively to do so, preferably during their budget presentations before Congressional authorization and appropriation committees. It is doubtful that any person in the higher realms of authority in any of the agencies are aware of the STI development thrust of the 1960s.

Perhaps I am overly cynical in my assessment of OSTP's lack of interest in Federal STI matters, but I think not. If I took OSTP's suggestion literally, a survey of scientists would be the next order of business, but lacking a staff and other resources, the task of galvanizing the highly dispersed and large scientific community to convince OSTP to get into the fray is too formidable for a few individuals like myself to undertake. Even with the skills, energy, and tenacity of a Mitch Snyder, the famed advocate for the Washington homeless, we might be able to mount a campaign, build a loyal constituency, obtain media support, and ultimately enlist a firm base of needed scientists willing to join the crusade, but concerned citizens like the author are conditioned to act within the rules, appeal to persuasion, and avoid confrontation.

6.2.6. Nevertheless, there is a reason for optimism. We vividly recall that several years before COSATI was formed in the early 1960s, there was no visible interest on the part of Federal R&D managers and the science community in and out of government to create a strong Federal STI program. Suddenly, Senator Hubert H. Humphrey held Senate Operations Committee hearings in which he convinced the Science Advisor to the President and Federal agency heads that it was in their interest to establish strong 'focal points' to organize and manage the agency STI programs. And this was what they did, including the establishment of COSATI as one of the committees of the Federal Council for Science and Technology.

Senator Humphrey and his staff were justifiably proud of their seminal efforts and maintained their interest in the progress of COSATI and its program, even when the Senator Humphrey became the Vice-President of the United States some years later. At that time, the congressional interest shifted to Congressman Emilio Daddario, House Committee on Science and Technology. His voice in the search for improved Federal STI plans, policies, and practices was loud, clear and respected. In later years, after Congressman Daddario left the House of Representatives to run for the office of governor of Connecticut, the mantle of the congressional 'STI-whip' was donned by Congressman George E. Brown (D.Cal.). This congressman and his colleagues were the architects of the science legislation that brought OSTP into the White House. The earlier OST was not a legislated entity, which made it possible for President Nixon to dismiss it summarily. Thereafter, Congressman Brown sought by persuasion to convince the Director of OSTP to establish responsible for government-wide STI oversight. The bill also called for the establishment of a Federal information policy institute, among other provisions.

Unfortunately, the bill did not get the necessary support in Congress to become a law. It has subsequently been re-introduced into the House hopper of bills annually by Congressman Brown with the hope that one day it would 'catch the right tide' as it did in the early 1960s.

6.2.7. The key to improving government STI programs, as this observer sees it, is to re-employ the tactics of Senator Humphrey, if OSTP does not take the initiative on its own .

The stakes for the government and the United States get higher and higher with each passing day.

6.3.0. The Need to Create a Federal and National Policy and Posture for the Successful Transfer of National and International STI Since the days of COSATI, much water (information) has flowed under the science and technology bridge to change the information environment. Some of these forces are listed:

6.3.1. The influx of new information technology and techniques into the public and private sector research and development apparatus, and into the growing information sector continues. The explosion of personal computers in the United States and abroad has considerably widened the information audience, hence information access and consumption. Federal agency STI managers have, except in one or two agencies, have been unable to extend instrumental access directly to this group.

6.3.2. Facilitated by the new information technology, the traffic, real and potential, of vast amounts of scientific and technical information and data continues to increase along with Federal and private sector R&D budgets. It was COSATI's and the PSAC (Weinberg) Panel's expectation that with the further development of specialized information programs, designed to screen and find rapidly in the mountain of newly produced knowledge stores generated by the government, high grade, industry-applicable STI. This expectation did not materialize. There is a belief on the part of more than a few observers, the author included, that foreign interests may have been more successful in scouring, finding and exploiting American STI than have counterpart Americans. While this has not been completely

proven, there are enough examples of this phenomenon in the electronic and other high-technology fields, to sustain concern. In other words, foreign organizations have developed counterpart information analysis centers adept at fingering vital information for exploitation better than we have. It was COSATI that saw this need in the 1960s. Its demise, without a successor organization to push, as it had, for improved indigenous STI exploitation, was a large mistake not generally perceived. This is the kind of growth pole that the Federal government should have further developed in the 1970s and 1980s, a bridging action that would have been welcomed, one that did not step on sensitive toes.

6.3.3. Rapid growth of computerized databases and networks in the United States and abroad serving science and technology will continue. Many of the Federal science and technology databases are accessible to users through commercial information services. This is an acceptable alternative, a healthy one that might bring higher monetary return for the STI. To date, however, there has been very little incentive on the part of the Federal STI managers to work more closely with the private database vendors to improve and promote the information services. Encouragement of this partnership has not been significantly encouraged.

6.3.4. Nagging trade imbalances, increasing recognition of the national weakness for rapidly converting science into technology, and the loss of valuable STI because of security inadequacies have plagued and will continue to plague the country. It is hard to push for a governmental STI center, if the need is not recognized in the White House, Congress and other influential circles. Nevertheless, common sense cries for a stronger Federal and national STI policy.

6.3.5. Efforts on the part of the Administration to withhold or otherwise control the dissemination of "sensitive" STI has been challenged by publishers, library groups, academia, media and others. The inability to find an acceptable compromise is a challenge.

6.3.6. Even as these problems are detected, the further "globalization" of the world's economy is a complication that will have an effect on major information systems in the near future. New transborder information flows, procedures, arrangements, standards, safeguards, and the like will be needed. With an increase in globalization, private and public information interests will be forced to re-align their programs and change their ways. There are no signs that the Federal government is reacting to the shift, making required studies, or developing a policy and program equal to the need. Of course, there may be stirring in the Department of Commerce and in other concerned agencies about impact of the growth of globalization, but I suspect that the studies and discussions might not deal with information flows, ownership and related matters. Moreover, even if global information policy issues are being discussed in individual agencies, there is a larger need for a government-wide dialogue, together with joint discussions with the private sector interests. If discussions are taking place in the individual Federal agencies, it should be remembered that each of marches to the sound of different drummers and that is the problem. The question boils down to --considering the increase in the globalization of industry and commercial services, what should be done in

a concerted manner so that our national and Federal information programs can play a vital role?

6.3.7 Ever since COSATI was terminated in the early 1970s, the status of the Federal agency STI managers has become tenuous, diminished, and even disheartened. Their staffs and their budgets have been reduced, as have their once close association with the agency R&D managers. For the remaining STI cadre, with the notable exception of DHHS's National Library of Medicine, there is now little or no incentive or encouragement to improve Federal STI programs. For the Federal STI community, simply surviving seems to be the order of the day. Authorities need to ask the question: should the de facto policy of Federal STI program shrinkage be reviewed? The answer has to be in the affirmative. A new government-wide policy to assure the active support of Federal STI managers and their programs by Congress, the Executive Office of the President, and agency top-level R&D managers and policy-makers is a sound and necessary investment. An integrated, coordinated, well managed, future-oriented government-wide STI program is a necessity.

6.3 8. Federal agency relationships and interaction with scientific and learned societies and commercial information groups has dwindled badly during this period. It should be a matter of Federal policy to encourage close interaction between the public and private STI sectors. A central COSATI-like body is badly needed to resume this practice.

6.4.0. The Need to Re-Establish a Successor to COSATI to Improve Cooperation and Coordination Within the Public STI Sector

6.4.1 The need for official action to bolster the Federal STI program has ballooned with the passage of time and events. Among the first actions of the Bush Administration should be the restoration of the STI coordination function within and between agencies. In some of the larger agencies, coordination of STI matters has been curtailed. It has become apparent to the writer that visibility of information programs is, from the standpoint of the individual R&D managers, unnatural, a condition to be shunned--the Macy-Gimbel syndrome carried into the laboratory. This attitude of 'keeping information clutched closely to one's breast' is one of several reasons for the premature death of the Smithsonian Science Information Center, that operation that maintained a computerized inventory of ongoing Federal R&D projects. When the program was curtailed, Commerce's NTIS was asked to take on the task, but without funds and personnel spaces to do so. The listings were given to a contractor to undertake on a commercial basis. This was the virtual end of sharing, except for some interaction going on among individual bench workers in some Federal research areas. It would be easy to claim that the termination of the science information exchange has resulted in severely injuring Federal R&D, a careful study is needed to find this out, but it does reveal that even scientists and R&D managers working in the public sector are not anxious to tell their colleagues what they are doing. When OST and COSATI were in the information business, there was an effort to strengthen science information exchange in the Federal government. That, too, was a casualty. In the absence of a well constructed study to find out. This in my opinion, has not helped the program. In an era when secretiveness is enshrined and fraud in science has increased to the flash point, it is a



good idea to require that the ventilation and openness that coordination and cooperation bring. If COSATI was still in being, it -certainly would attack the problem.

6.4.2. During the period when COSATI was alive, there was a conscious effort on the part of the White House and Congress to require the orderly growth of Federal STI and communication activities. With funds provided by the Congress for R&D, a fraction thereof was used for studies and other research to improve the individual STI programs of agencies, as well as government-wide STI programs. Thus, COSATI and OST were able to get financial assistance from NSF and the agencies for a number of improvement studies, some of which are reported in the other chapters of this book. Millions of dollars were used for this purpose. Even OMB recognized the need for such investment. The funds and the projects have sharply diminished, dried up; only a trickle remains. During this period in the ever-growing Information Age, there should be more information experts and dollars available for studies. Sadly, NSF has turned its back on STI matters and spends little of its growing bag of money in this field. Federal agencies are in the same boat, except possibly in the health field, where national needs are receiving priority attention. But even here, funds for information program development have not kept pace with requirements for better programs. The congressional Office of Technology Assessment has been active in information research in recent years, but this program has not contributed much to strengthening government-wide and agency STI programs. The Federal cupboard for STI R&D is bare. We are paying for the lack now; it will cost us much more later, if it is not too late to reclaim our earlier lead in STI system development. In the absence of White House action, a few years ago, despairing that there would be action at higher levels, several Federal information managers formed an interaction group they call CENDI, an acronym made up of names of the involved agencies: Commerce, Energy, NASA, NLM, DOD, and I for information. Most of the participants are STI disseminators and are not necessarily members of agency R&D operations, a serious problem that limits what the group can do. Another group has tried to fill part of the vacuum, the Federal Library and Information Center group, acronym FLIC. It operates under the leadership of the Library of Congress and focuses on library coordination and sharing of resources, primarily. This group is even more remote from Federal R&D management. It is a useful program, though limited in what it can achieve. But the vacuum still needs to be filled. For starters, we require a COSATI successor unit operating at White House level. Simultaneously, an ad hoc group, made up of knowledgeable scientists and information experts from the public and private sectors, should be formed and charged by the Science Advisor.

6.4.3. These two actions are a beginning, more will be required. It will take a leader with vision, imagination, drive, and hard work to bring the pieces together again. It will take a Science Advisor who gives his technical assistant full support. It will take an OMB that is sympathetic to the overall goal of a new and superlative Federal STI program to support the Federal R&D program and the national technology transfer program.

6.5.0. The Need to Bring Harmony and Cooperation Between and Among the Public and Private STI Sectors

6.5.1. The important goal in creating a strong national STI program, designed to act as a springboard to the decade ahead, is to get strong cooperation between the principals in the public and private STI sectors, not an easy task. Certainly, spirited competition and constructive friction between the two sectors will, if balanced by a cooperative program, can be a stimulant to progress for both groups.

6.5.2. To receive the required support from the private information sector, it will be necessary for the government to improve its internal STI program, which, in a sense, is competitive with some private sector programs. In this regard, the government should make it clear that it will enlist the help and advice of the private sector before it embarks on any new governmental information programs. It should agree that it will not duplicate ongoing private sector STI programs or start new ones that the private sector is willing to provide. The government must assure the private sector entry to the COSATI-successor office on a continuing basis, preferably through organizations like the Information Industry Association, American Library Association and the American Chemical Society, but it should be understood by all that its door will be open to all individuals and companies as well.

6.5.3. The government focal point should become extensively aware of the problems of the private sector in their dealings with agencies in the Federal establishment and divers authorities, governmental and private, in other countries. The high-level Federal authority, to earn the respect and assistance from the private sector, must be ready to take whatever actions are needed to assist the private sector in solving their problems. The governmental focal point must closely interact with the private sector to keep it informed of governmental issues and initiatives that would or could effect any component of the U.S. information community. This is the way to build teamwork. The information field is in flux, so the issues and problems keep changing. This is why a one-shot effort to meld the public and private information sectors together is not enough. There must be a long-time commitment to build the team and reap the benefits that will come to the public and private information sectors when they work together with a reasonable degree of harmony.

6.5.4. The private information sector will benefit from the arrangement in at least four ways. First, it will have more knowledge about ongoing and planned government STI programs. Second, commercial vendors can reasonably expect increased cooperation from the government in obtaining databases created by Federal agencies to market. Third, with the growth of the global economy, the value of new STI is bound to increase even more. The private sector, with improved access to Federal STI, will be better able to compete in the world market. Fourth, most country information systems will be operated by government agencies rather than by the private sector. The Free World will have a mixed system, such as exists in the United States. Obviously, it will be to the interest of the U.S. public and private information sectors to operate harmoniously together in this climate. A complicating factor is the surge of buyouts of U.S. media, publishing and information services by German, French, Canadian, and Dutch interests. Two causes are cited: the low value of the dollar and the size and stability of the U.S. market.

This development is being eyed by some in the U.S. as potentially dangerous, but the purchases of U.S. corporations by foreign interests is small compared to the size of American investments in other countries.

#### 6.6.0. The Need to Improve Substantially the Gathering and Analysis of the Vital STI Produced in Other Countries

6.6.1. The ability to gather globally produced STI has never been the long suit of U.S. government and the private sector. It is mandatory that this Federal and national weakness be carefully studied and remedial action taken. Up to now, there has been little incentive for U.S. industry to share information that it gathers with the government agencies. The information referred to here is not so much STI, but intelligence about conditions in other countries, political and economic barriers and inequities they are encountering which prevent them from selling their information products or obtaining certain kinds of information generated in foreign countries they need. A huge generator of STI itself, the U.S. government might be able to apply leverage to help U.S. commercial groups and scientific societies overseas.

Within the U.S. government, information-sharing can and should be improved. STI is gathered by the intelligence sector, by science and other State Department officials, by agency personnel, and others. These programs are only thinly coordinated, if at all. Much of the data gathered from overseas sources is dissipated, rather than shared. If there is a solid program in the Federal government to share and exploit global STI, it is a well-kept secret. This is a matter for the OSTP immersion with the help of OMB and the Federal agencies and other stakeholders.

6.6.2. Our national weakness in mastering languages other than English is well recognized; our failure to rectify the problem with a hard-hitting, major program is nothing short of scandalous. The piecemeal approach now being followed is too little and too late. One of the first steps to be taken is a study of what other countries are doing to acquire language literacy. What we find should be well publicized in our print and electronic media to set the stage for a beefed-up U.S. language literacy crusade. There must be a well planned, well organized national educational program that starts with kindergarden and continues into college. Before students are promoted to higher grades, they should be required to pass language tests. Summer camps that feature attainment of language skills, as well as computer familiarity, should be encouraged. Universities should undertake much more vigorous 'additional language' programs. The flow of Federal funds for research into universities should be modulated in accordance with the vigor shown by the institution in teaching second and third languages to their students. As an incentive, preference in providing student loans should be given to those applicants who are mastering language skills. Drastic actions, like requiring candidates for selected public offices to demonstrate facility in languages in addition to English, should be considered. These suggestions are examples of what can be done, there are many others that deserve attention.

6.6.3. Hard-working information centers, some centralized, some dispersed, in public and private facilities in Moscow, Japan, other Pacific Rim countries, and in Europe are arrayed against us. In the West, in just a

few years, the combined information-gathering and information-screening capabilities of the countries comprising the Common Market in Europe will add considerably to the information power of our rivals. We must understand that all countries in the world that are in the economic progress sweepstakes are going to take further steps to strengthen their information-gathering and information-exploiting capabilities. They cannot afford to stand still. This is the fact of life that we must react to over the next few decades at least, perhaps forever. In my Government Computer News column "Information Geopolitics", this is the point I continue to hammer home--the information war is being waged on a number of fronts. The United States will lose the war, unless it takes what is and what is going to happen seriously. It is not a matter to be left only to 'market forces.' The U.S. government is going to have to gird its figurative loins and get into the information geopolitical game

6.6.4. During the self-examination, we should ruthlessly appraise the strengths and weaknesses of our capabilities to screen and analyze the knowledge gathered. Here again, is the need for superior, continuing teamwork between the public and private sectors. The problem of protecting intellectual property, which is receiving considerable attention throughout the world, should be considered in this connection.

6.6.5. This is an area where talented people are required, people who are currently in short supply. Actions are needed to encourage the growth of a pool of experts, who will be honored by their peers for their contributions.

6.7.0. The Need to Upgrade the Management of Federal and national STI Programs

6.7.1. For starters, let us admit that Federal STI programs need improved management. They are costly, though statistics are hard to find, amounting at least to several billion dollars annually. In former years, there were several attempts to keep tabs on STI costs. NSF gathered statistics at one time and so did COSATI. King Research Company has collected figures in a study undertaken for the Department of Energy in the late 1970s. The difficulty in getting more exact numbers has to do with the lack of an OMB requirement for STI line items in annual agency budgets. For a brief period during the 1960s, OMB was deeply interested and called on COSATI to gather STI cost data for this very expensive, but necessary program. For reasons never given, OMB lost interest in continuing the special budget, a mistake in judgement, as I then saw it.

When this happened, although probably not intended by OMB, it was a signal to the agencies to stop gathering STI cost data. Let me point out that the Federal STI managers, who were the members of COSATI, had been given little or no control of agency-wide STI budgets and expenditures in their agencies. Their control was largely limited to STI dissemination, which admittedly is only one part of the total STI cost. This anomaly was discussed with OMB, but no help was forthcoming; agency officials in charge of much of the STI funding were not anxious to give up their control. This condition persists today, which is one reason that I advance for the need of improved STI management.

6.7.2. There are other reason why STI management has to be improved. Much of the agency STI funding comes from the R&D budgets, but agency R&D chiefs, with a couple of exceptions, no longer control STI activities. They do not meet regularly with agency STI managers as they did in the past. Absent close association and involvement, agency R&D directors are no longer knowledgeable about STI costs, problems, issues, and opportunities, but neither is any other group in the agencies. This is a formula for STI program failure, a dead give-away that careful planning, operating, and supervising of expensive agency functions are no longer required. When STI programs, which contribute so much to the success of the Federal R&D programs, are adjudged as similar to such activities as: snow and trash removal, floor waxing, door guarding, and other housekeeping programs, clear thinking disappears. With the need to improve Federal R&D programs, the need for greater productivity, and the need for better technology transfer, the erosion of strong STI programs makes no sense. The transfer of elements of the Federal STI program to agency programs, other than R&D, has been and will continue to be unsuccessful. The STI program is and will always be an integral part of the agency R&D program because of its nature.

6.7.3. There is a stronger reason why management of STI programs need top-level attention and reform. It has to do with the nature of information, during what has been called the Information Age. Because of the extraordinary proliferation of STI and related information, added to a similar proliferation of electronic information technology, databases and networks, the cost of information operations has soared, even though the per datum cost of handling information may have decreased as costs of computers have fallen. In the service economy of the Post-Industrial Age, the information establishment has been vigorously expanding, but so have costs. The real competition going on between countries deals with how much good information they generate, access, and handle at the lowest cost. I call it getting the "information edge." I could be mistaken, but I do not think that Federal R&D managers take this reality into consideration. Perhaps, this is true in other knowledge-rich fields in and out of the government. Information systems and the skill of management are hard to develop and evaluate at best. When the top-level managers are information-ignorant, as many are in this period of transition, the costs of information-handling can be astronomical. How much of America's dilemma in world competition has resulted from endless national investment in generations of computers, in the mishandling of information, in costly facilities, in the increasing costs of education and training, and more, is hard to find out. If we want to get the information edge over competitors in the U.S. and abroad, the task must be undertaken.

6.7.4. Effective management of information resources is a necessity in all organizations, especially large and dispersed ones. Usually, information managers focus their attention on their own organization's information-handling needs, and this makes sense. A few rungs up the ladder, some information managers will be more sophisticated, so they will also focus on the information time-space environment of their suppliers, customers, regulators, common carriers, and competitors, all organisms that operate in their total information milieu. If they are at the top of the ladder, they will be even more proficient, with the ability to track and analyze the quantity and quality of the internal and external information flows;

trace the human and instrumental barriers and inhibitors of proper information flows; and isolate economic, social, political, and cultural factors that influence the total information system performance. Of course, the information managers will be interacting with planners, analysts, and other organizational executives when and if they assume some of these more advanced functions that deal with information. As I see it, the ascension to power and prestige for information executives, both in the public and private sectors alike, is tied to expanded involvement with organizational functions in which information and analytical skills play a key role. .

#### 6.8.0. The Need to Provide Access to All Legitimate Users in the Government and On a Need-to-Know Basis to Users in the Private Sector

6.8.1. In the close to three decades of my involvement in the Federal STI business, I have found that the importance of users in the information chain has been thoroughly emphasized by information system managers. Including NTIS, I would give them a high grade for stressing this requirement.

6.8.2. The diligence has not been that great when it comes to two types of STI. The first of these is data of the type collected by NASA in its space program, and Geological Survey in its geophysical data collection. Since the end of COSATI, the Federal generators and handlers of different bodies of scientific and technical data have had comparatively little interaction. There has been some through the National Research Council's Numerical Data Advisory Board and the Office of Standards Reference Data, National Bureau of Standards. The second type of data are those describing proposed and ongoing Federal R&D projects and their work elements. The Smithsonian Science Information Exchange did, in earlier years, maintain a registry of R&D project work units. The formal project, along with the SSIE, has been abandoned. Some but not all project data is provided by the Federal R&D agencies to NTIS, which gathers their inputs and transfers them to a private database vendor. Some agencies doing similar R&D work may by special agreement transfer project data to each other, but there is no government-wide requirement to do so. In years past, Congress was insistent that sharing take place. GAO made a number of studies in this area and reported deficiencies. Paradoxically, Congress has been quiet on the subject, even though the need has grown along with the size of the Federal R&D budget.

6.8.3. Even in the R&D report area, Federal agencies have a mixed exchange record. Presumably, primary dissemination of R&D reports, interim and completed, between Federal agencies was continued, but there are no information being kept that would reveal the extent of coverage. Alternatively, agencies may transmit announcements of completed reports, inviting other agencies to request the reports directly or through NTIS. Without a survey, how well this system is working is hard to find out. Unless the White House or Congress wants the information, change is unlikely. Incidentally, the Grace Cost-Cutting Commission report on R&D, which was completed a few years ago, called for a return of the SSIE function and provision of new funds to keep it going, probably the only of one of more than 2,000 recommendations that advised the President that more money should be spent for this function.

6.8.4. A current problem, as seen by many, has to do with an attitude all-too-common in the U.S. work-place. Too many executives are prone to look for short range profits, rather than concentrate on long-range goals, as does the most successful manufacturing and trading country, Japan. Japan has fashioned its information systems and subsystems to conform to its leadership drive. The systems operate in the short term very efficiently, but they do the same in the long term. We can probably say that the widespread, but less coherent U.S. information systems are arrayed against the success-oriented Japanese information systems. As early as 1970, perhaps earlier, Japanese thinkers were already proposing an integrated national information system, encompassing government, industry, commerce, science, education, and other fields of knowledge. The notion that the U.S. would become more competitive, if it would concentrate on national information programming that features easier interconnections and better information-sharing at all levels, continues to be anathema. The mere mention of a national information system for science and technology seemed to conjure up fear and avoidance. Since our OST-COSATI experience with an information system with that name in the 1960s, I have concluded that we should not use the word 'national', until we achieve a de facto one. using a different title, something like the American Consolidated (or Integrated) Information Network for Science and Technology. The usual caveat should be repeated here. We are referring to a harmonious, integrated array of STI systems and subsystems, not a monolith. Ownership and responsibility for individual systems would not change.

6.8.5. Of course, there may be some kind of an unseen mechanism at work that will ultimately bring order and integration to the atomized information systems now in place. The writer prefers a less mystic, more immediate approach that can proximate the goal by dint of hard thinking, hard work, and good cooperation. A program like this will feature access and cross-sector information-sharing.

#### 6.9.0. The Need to Encourage all U.S. Scientists and Engineers to Participate in the Development of Federal and National STI Systems

6.9.1. The contribution of American scientists and engineers in the history-making invention and development of the demiurgic machinery of the Information Revolution is nonpareil. Otherwise, as expressed elsewhere in this book, it seems to this observer that many American scientists and engineers often seem to be reluctant to welcome change in the information and communication systems they were trained to use during their academic days. I refer here to journal publication and the comfort of belonging to "invisible colleges." However, most are now at the cutting edge in the employment of modern information technology at their work stations, including wide use of computerized databases and electronic networks.

6.9.2. Nevertheless, only a small minority are interested in the "big information picture." This makes for a serious problem. Internal information systems, those used in institutions or parts of scientific disciplines, do not communicate efficiently with other similar systems. This appears not to disturb most scientists and engineers, but hermetic, dedicated information systems often inhibit the flow of information and data. Indifference to the good that could come from reducing obstacles to

information flow to other parts of the science and technology community is still prevalent. Obviously, there would be justified resentment, if information groups outside the professions, even those qualified and well-meaning, 'tinkered' with the total system without the full involvement of scientists and engineers. The logical alternative is to invite the scientists and engineers, with the help of information experts, preferably those that combine information expertise and scientific/engineering know-how, to assert control over the further development and integration of American STI systems.

6.9.3. The catalyst to bring about this important cooperative venture, once the scientists and engineers agree to go along, will be the Federal government, both the Executive and Legislative Branches. Their leverage comes from control over Federal funds. Their motives are: (1) to improve Federal R&D processes (in-house and contractor) by means of greatly improved Federal STI programs; (2) to stimulate national productivity and competitiveness by improving the quality of technical information and the speed of its delivery to legitimate users; and (3) to facilitate the transfer of research into technology by a variety of measures, including an improved and dedicated information system.

6.10.0. The Need to Evolve a Federal and National STI Plan that Will Give the United States Clear Direction to the Year 2000 and Beyond

6.10.1. Again, we arrive at the junction of two roads. The first of these is "no planning" Federal and national STI systems; the second is "planning" Federal and national STI systems. The second road could be divided into "part planning" and "full planning." For our purposes, I will dismiss consideration of "full planning" as beyond human capabilities, hence only "part planning" is considered feasible. This qualification is necessary, because we are addressing a highly complex, volatile mechanism in the public and the private domains and because we must avoid at all costs a government-superimposed information system that could inflict possible damage to the precious 'open-endedness of science.' This reduces the degrees of freedom we have in making deep changes. We are further inhibited by the fact that major information systems are already in place; we are not starting de novo. The managers of these de facto information systems will resist any substantial change. To cap these obstacles, lacking an experienced cadre of experts with the requisite knowledge to prepare the STI plan, it would take time to assemble them and prepare the plan.

Finally, there is the international dimension. The U.S. STI program cannot be an island unto itself, it has to be part of the world information order. Whatever actions we propose to take to improve our STI program must dovetail with the world STI system to stand the test of time. This means that when we start action to improve our system, we are also embarked on a program to change and possibly improve the global STI system.

6.10.2. If we travel this route, based on previous experience, we are also suggesting to the international community that we are dissatisfied with international STI progress and intend to offer constructive changes in the near term. It is almost a certainty that should the U.S. embark on this journey, the international STI community will press for its involvement.



Slightly chauvinistic that it might have been, it was my conjecture during this era that the main reason that prompted UNESCO to sponsor the UNISIST world-wide STI project in 1967 was the determination of COSATI to in establish a national information system for science and technology. The failure of the Executive Office of the President to implement the modest recommendations of FCST to work towards a national STI system may have been a serious strategic blunder. When this happened, from my angle of vision, when the U.S. national program ground to a halt, the competition that at least in part led to the UNESCO UNISIST drive for a global STI system, also diminished.

Two decades later, the forces that originally propelled COSATI into its national information system program are still operating. They include the need for: more orderly growth of all STI services; improved, less duplicative STI services; more rapid STI access and information flow for a growing army of users; much improved utilization of R&D results to expedite technology transfer; more cooperation between the public and private information sectors; substantial increase of combined STI research and studies; and increased efficiency and economy in STI system development and operations. These and other new needs call for stronger planning Federal and national planning. Moreover, if we do not build up a head of steam to do it, I predict that it will be done by other countries, perhaps the Common Market group.

6.10.3. The advantages of evolving annually updated national STI plans will be manifold. The combined, continuing exercise will provide legislators and policymakers, as well as operators of ongoing STI programs and developers of new STI services, with general STI system guidelines, outlines, and checklists. The plans will feature time-phased growth models for STI systems in major issue- or problem-directed areas, such as the environment, nuclear energy, space, education, and health. They will include discipline-based STI systems and their interplay with problem- and crisis- management information systems, such as crime, AIDS, protection of intellectual property, waste disposal, decay of the cities. The list of the latter grows almost daily.

6.10.4. The plans will provide lists of standards, protocols, networks, databases, laws, regulations, ongoing and recently completed STI R&D projects, international information-sharing agreements, international organizations sponsoring STI programs, country and regional information programs and facilities, information analysis centers, major Federal STI systems, sources of Federal and other STI funds for all STI services, STI hotlines to answer questions and obtain information, lists of applicable ongoing and completed information R&D and studies, and the like. This function could be an in house or contracted-out facility, operating under OSTP like an information analysis center. It will issue annual and special reports, as directed.